DATA SHEET

74LVT16240A

3.3 V LVT 16-bit inverting buffer/driver (3-State)

Product data
Supersedes data of 1998 Feb 19

2003 Feb 21

Philips Semiconductors

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3.3 V 16-bit inverting buffer/driver (3-State) — 74LVT16240A

FEATURES

- 16-bit bus interface
- 3-State buffers
- Output capability: +64 mA/–32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus-hold data inputs eliminate the need for external pull-up resistors to hold unused inputs
- Live insertion/extraction permitted
- Power-up 3-State
- No bus current loading when output is tied to 5 V bus
- Latch-up protection exceeds 500 mA per JEDEC Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model

DESCRIPTION

The 74LVT16240A is a high-performance BiCMOS product designed for V_{CC} operation at 3.3 V.

This device is an inverting 16-bit buffer that is ideal for driving bus lines. The device features four Output Enables ($1\overline{OE}$, $2\overline{OE}$, $3\overline{OE}$, $4\overline{OE}$), each controlling four of the 3-State outputs.

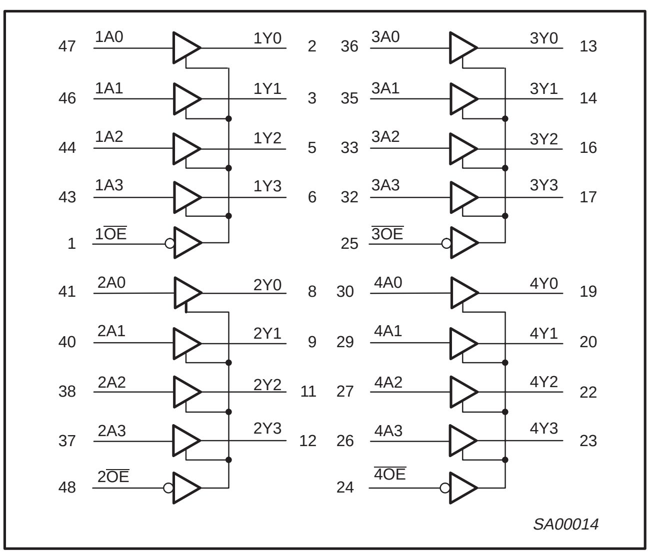
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS T_{amb} = 25 °C	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay nAx to $n\overline{Y}x$	C_L = 50 pF; V_{CC} = 3.3 V	1.9	ns
C_{IN}	Input capacitance $n\overline{OE}$	V_I = 0 V or 3.0 V	3	pF
C_{OUT}	Output capacitance	Outputs disabled; V_O = 0 V or 3.0 V	9	pF
I_{CCZ}	Total supply current	Outputs disabled; V_{CC} = 3.6 V	70	μA

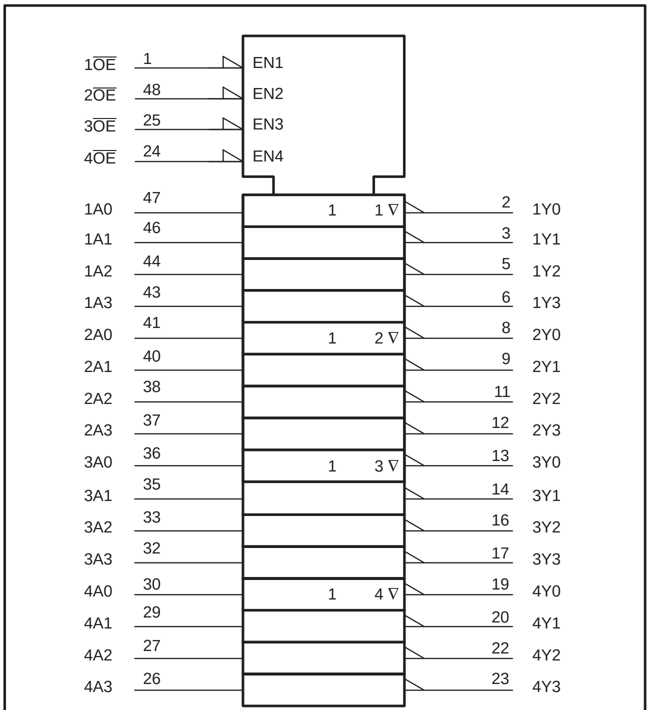
ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	PART NUMBER	DWG NUMBER
48-Pin Plastic SSOP Type III	–40 °C to +85 °C	74LVT16240ADL	SOT370-1
48-Pin Plastic TSSOP Type II	–40 °C to +85 °C	74LVT16240ADGG	SOT362-1

LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



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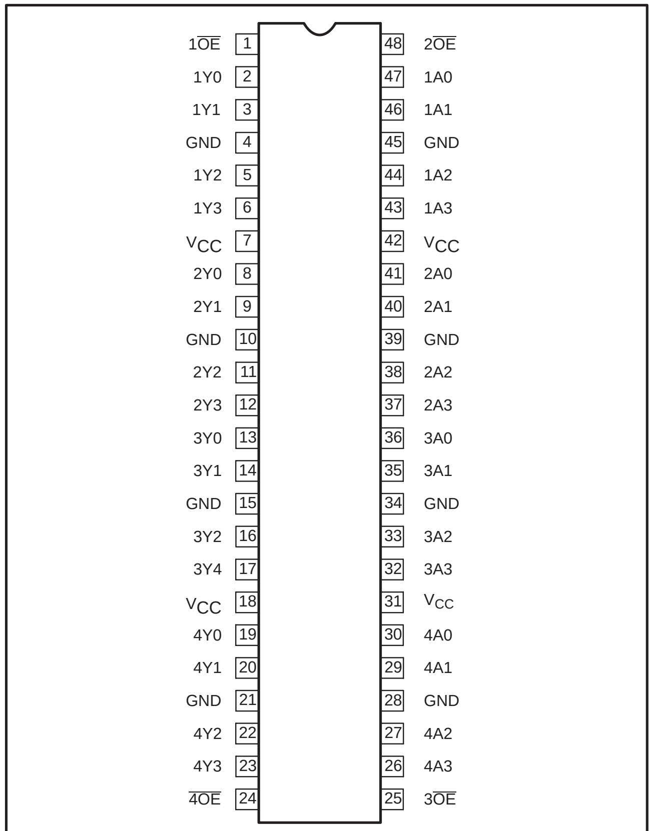
PIN CONFIGURATION



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FUNCTION TABLE

Inputs		Outputs
n$\overline{OE}$	**nAx**	**n$\overline{Y}$x**
L	L	H
L	H	L
H	X	Z

H = HIGH voltage level
L = LOW voltage level
X = Don't care
Z = High Impedance "off" state

PIN DESCRIPTION

PIN NUMBER	SYMBOL	NAME AND FUNCTION
47, 46, 44, 43, 41, 40, 38, 37, 36, 35, 33, 32, 30, 29, 27, 26	1A0-1A3 2A0-2A3 3A0-3A3 4A0-4A3	Data inputs
2, 3, 5, 6, 8, 9, 11, 12, 13, 14, 16, 17, 19, 20, 22, 23	1$\overline{Y}$0-1$\overline{Y}$3 2$\overline{Y}$0-2$\overline{Y}$3 3$\overline{Y}$0-3$\overline{Y}$3 4$\overline{Y}$0-4$\overline{Y}$3	Data outputs
1, 48, 25, 24	1$\overline{OE}$, 2$\overline{OE}$, 3$\overline{OE}$, 4$\overline{OE}$	Output Enables
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0 V)
7, 18, 31, 42	V_{CC}	Positive supply voltage

ABSOLUTE MAXIMUM RATINGS[1, 2]

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		–0.5 to +4.6	V
I_{IK}	DC input diode current	$V_I < 0$ V	–50	mA
V_I	DC input voltage[3]		–0.5 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$ V	–50	mA
V_{OUT}	DC output voltage[3]	Output in Off or HIGH state	–0.5 to +7.0	V
I_{OUT}	DC output current	Output in LOW state	128	mA
		Output in HIGH state	–64	
T_{stg}	Storage temperature range		–65 to +150	°C

NOTES:
1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.
3. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		MIN	MAX	
V_{CC}	DC supply voltage	2.7	3.6	V
V_I	Input voltage	0	5.5	V
V_{IH}	HIGH-level input voltage	2.0		V
V_{IL}	Input voltage		0.8	V
I_{OH}	HIGH-level output current		–32	mA
I_{OL}	LOW-level output current		32	mA
	LOW-level output current; current duty cycle ≤ 50%; f ≥ 1 kHz		64	
$\Delta t/\Delta v$	Input transition rise or fall rate; Outputs enabled		10	ns/V
T_{amb}	Operating free-air temperature range	-40	+85	°C

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS T_{amb} = –40 °C to +85 °C MIN	TYP[1]	MAX	UNIT
V_{IK}	Input clamp voltage	V_{CC} = 2.7 V; I_{IK} = –18 mA			–0.85	1.2	V
V_{OH}	HIGH-level output voltage	V_{CC} = 2.7 V to 3.6 V; I_{OH} = –100 µA		V_{CC}–0.2	V_{CC}		V
		V_{CC} = 2.7 V; I_{OH} = –8 mA		2.4	2.5		
		V_{CC} = 3.0 V; I_{OH} = –32 mA		2.0	2.3		
V_{OL}	LOW-level output voltage	V_{CC} = 2.7 V; I_{OL} = 100 µA			0.07	0.2	V
		V_{CC} = 2.7 V; I_{OL} = 24 mA			0.03	0.5	
		V_{CC} = 3.0 V; I_{OL} = 16 mA			0.25	0.4	
		V_{CC} = 3.0 V; I_{OL} = 32 mA			0.30	0.5	
		V_{CC} = 3.0 V; I_{OL} = 64 mA			0.40	0.55	
I_I	Input leakage current	V_{CC} = 3.6 V; V_I = V_{CC} or GND	Control pins		0.1	±1.0	µA
		V_{CC} = 0 V or 3.6 V; V_I = 5.5 V			0.4	10	
		V_{CC} = 3.6 V; V_I = V_{CC}	Data pins[4]		0.1	1	
		V_{CC} = 3.6 V; V_I = 0 V			–0.4	–5	
I_{OFF}	Output off current	V_{CC} = 0 V; V_I or V_O = 0 V to 4.5 V			0.1	±100	µA
I_{HOLD}	Bus Hold current A inputs[6]	V_{CC} = 3 V; V_I = 0.8 V		75	135		µA
		V_{CC} = 3 V; V_I = 2.0 V		–75	–135		
		V_{CC} = 0 V to 3.6 V; V_{CC} = 3.6 V		±500			
I_{EX}	Current into an output in the HIGH state when V_O > V_{CC}	V_O = 5.5 V; V_{CC} = 3.0 V			50	125	µA
$I_{PU/PD}$	Power-up/-down 3-State output current[3]	V_{CC} ≤ 1.2 V; V_O = 0.5 V to V_{CC}; V_I = GND or V_{CC} OE/$\overline{OE}$ = Don't care			1	±100	µA
I_{OZH}	3-State output HIGH current	V_{CC} = 3.6 V; V_O = 3.0 V; V_I = V_{IL} or V_{IH}			0.5	5	µA
I_{OZL}	3-State output LOW current	V_{CC} = 3.6 V; V_O = 0.5 V; V_I = V_{IL} or V_{IH}			0.5	–5	
I_{CCH}	Quiescent supply current	V_{CC} = 3.6 V; Outputs High, V_I = GND or $V_{CC,}$ I_O = 0			0.07	0.12	mA
I_{CCL}		V_{CC} = 3.6 V; Outputs Low, V_I = GND or $V_{CC,}$ I_O = 0			4.0	6.0	
I_{CCZ}		V_{CC} = 3.6 V; Outputs Disabled; V_I = GND or $V_{CC,}$ I_O = 0[5]			0.07	0.12	
ΔI_{CC}	Additional supply current per input pin[2]	V_{CC} = 3V to 3.6V; One input at V_{CC}–0.6V, Other inputs at V_{CC} or GND			0.1	0.20	mA

NOTES:

1. All typical values are at V_{CC} = 3.3 V and T_{amb} = 25 °C.
2. This is the increase in supply current for each input at the specified voltage level other than V_{CC} or GND.
3. This parameter is valid for any V_{CC} between 0 V and 1.2 V with a transition time of up to 10 msec. From V_{CC} = 1.2 V to V_{CC} = 3.3 V ± 0.3 V a transition time of 100 µsec is permitted. This parameter is valid for T_{amb} = 25 °C only.
4. Unused pins at V_{CC} or GND.
5. I_{CCZ} is measured with outputs pulled to V_{CC} or GND.
6. This is the bus hold overdrive current required to force the input to the opposite logic state.

AC CHARACTERISTICS

GND = 0 V; $t_R = t_F = 2.5$ ns; $C_L = 50$ pF; $R_L = 500\ \Omega$; $T_{amb} = -40$ °C to +85 °C.

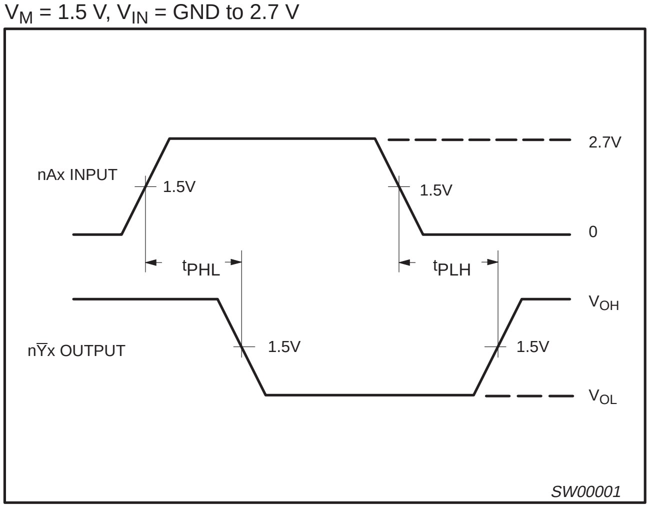
SYMBOL	PARAMETER	WAVEFORM	LIMITS				UNIT
			V_{CC} = 3.3 V ±0.3 V			V_{CC} = 2.7 V	
			MIN	TYP[1]	MAX	MAX	
t_{PLH} t_{PHL}	Propagation delay nAx to n$\overline{Y}$x	1	0.5 0.5	1.8 2.0	3.2 3.2	4.0 4.0	ns
t_{PZH} t_{PZL}	Output enable time to HIGH and LOW level	2	1.0 1.0	2.3 2.1	4.0 4.4	5.0 4.8	ns
t_{PHZ} t_{PLZ}	Output disable time from HIGH and LOW Level	2	1.0 1.0	3.2 3.0	4.5 4.4	5.0 4.8	ns

NOTE:

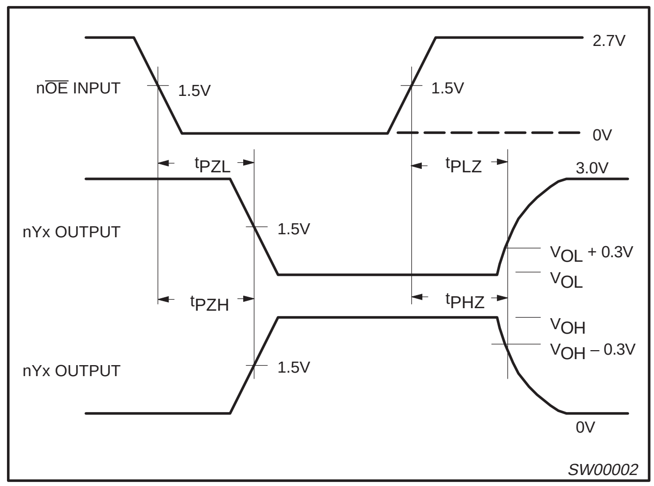
1. All typical values are at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C.

AC WAVEFORMS

$V_M = 1.5$ V, V_{IN} = GND to 2.7 V

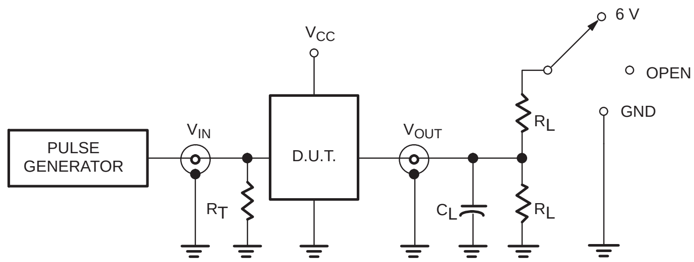


Waveform 1. Input (nAx) to Output (n$\overline{Y}$x) Propagation Delays

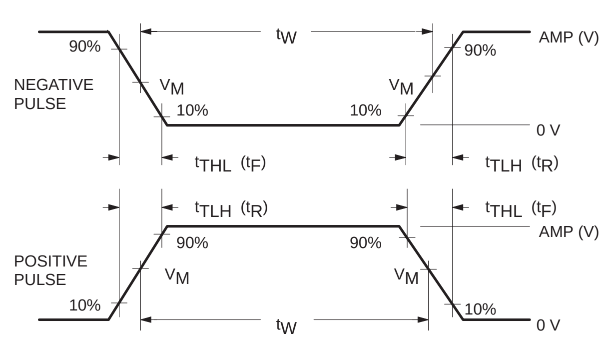


Waveform 2. 3-State Output Enable and Disable Times

TEST CIRCUIT AND WAVEFORMS



Test Circuit for 3-State Outputs



V_M = 1.5 V
Input Pulse Definition

SWITCH POSITION

TEST	SWITCH
t_{PHZ}/t_{PZH}	GND
t_{PLZ}/t_{PZL}	6 V
t_{PLH}/t_{PHL}	open

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

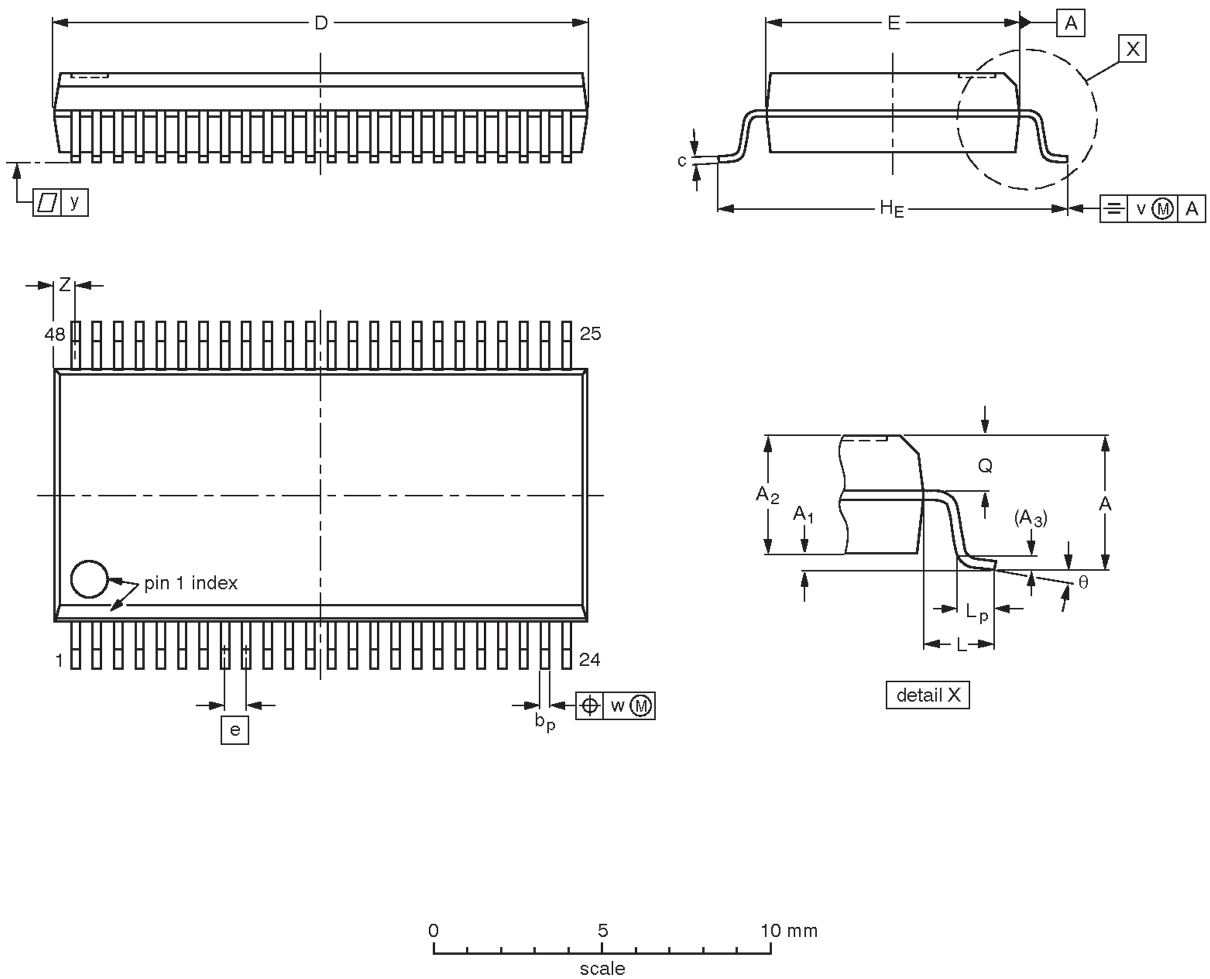
C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
74LVT16	2.7 V	≤10 MHz	500 ns	≤2.5 ns	≤2.5 ns

SW00003

SSOP48: plastic shrink small outline package; 48 leads; body width 7.5 mm SOT370-1



DIMENSIONS (mm are the original dimensions)

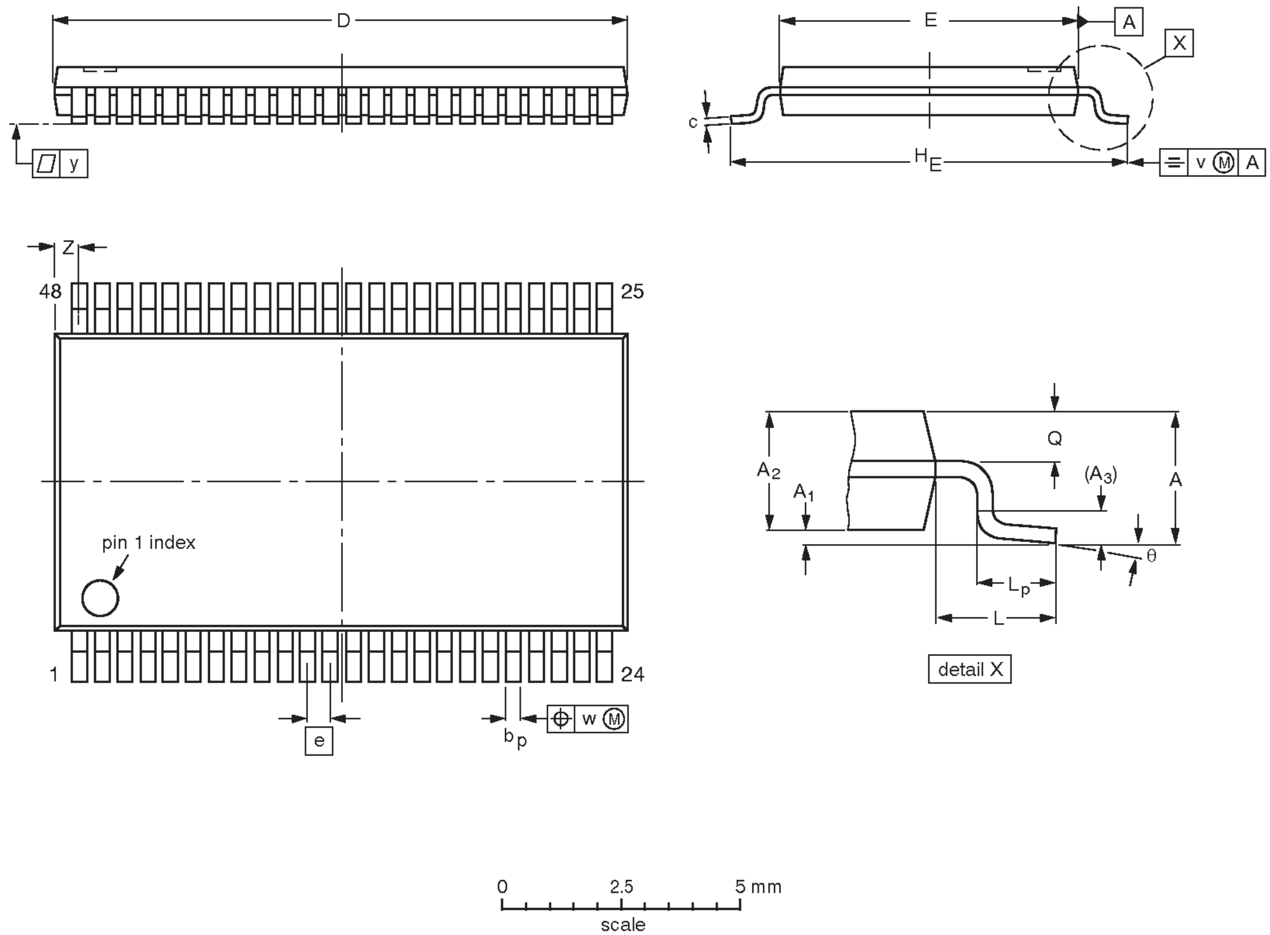
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.8	0.4 0.2	2.35 2.20	0.25	0.3 0.2	0.22 0.13	16.00 15.75	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT370-1		MO-118				~~95-02-04~~ 99-12-27

TSSOP48: plastic thin shrink small outline package; 48 leads; body width 6.1 mm **SOT362-1**



DIMENSIONS (mm are the original dimensions).

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	Z	θ
mm	1.2	0.15 0.05	1.05 0.85	0.25	0.28 0.17	0.2 0.1	12.6 12.4	6.2 6.0	0.5	8.3 7.9	1	0.8 0.4	0.50 0.35	0.25	0.08	0.1	0.8 0.4	8^o 0^o

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT362-1		MO-153				~~95-02-10~~ 99-12-27

3.3 V 16-bit inverting buffer/driver (3-State) 74LVT16240A

REVISION HISTORY

Rev	Date	Description
_3	20030221	**Product data (9397 750 11152); ECN 853-1776 29438); supersedes product specification of 1998 Feb 19 (9397 750 03547).** Modifications: • Ordering information table on page 2 corrected: remove 'North America' column. • "Logic symbol (IEEE/IEC)" on page 3 modified to correct pin names.
_2	19980219	**Product specification (9397 750 03547); ECN 853–1776 18990; supersedes data of 1994 Dec 15.**

Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definitions
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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